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APPLICATION NUMBER: ***60/629,688***
FILING DATE: ***November 19, 2004***
RELATED PCT APPLICATION NUMBER: ***PCT/US05/41981***

THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS ***US60/629,688***

UNITED STATES PATENT AND TRADEMARK OFFICE
DEPARTMENT OF COMMERCE

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PTO/SB/16 (04-04)
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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. EV528708433US

INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Andrew	Rowser	Issaquah, Washington
Christopher D.	Long	Maple Valley, Washington
Glen	Borland	Escondido, California
Leo	Hoarty	Kent, Washington

Additional inventors are being named on the ______ *separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max)

A DIRECTIVE, BROADBAND, HIGH GAIN, ACTIVE ANTENNA SYSTEM

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

[x] Customer Number: 25096

OR

[ ] Firm or Individual Name					
Address					
City		State		Zip	
Country		Telephone		Fax	

ENCLOSED APPLICATION PARTS ***(check all that apply)***

[x] Specification *Number of Pages* 6
[ ] CD(s), Number
[x] Drawing(s) *Number of Sheets* 2
[x] Other (specify): Return Receipt Postcard
[ ] Application Data Sheet. See 37 CFR 1.76

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

[x] Applicant claims small entity status. See 37 CFR 1.27.
[x] A check or money order is enclosed to cover the filing fees.
[x] The Director is hereby authorized to charge additional filing fees or credit any overpayment to Deposit Account Number: 50-0665
[ ] Payment by credit card. Form PTO-2038 is attached.

FILING FEE AMOUNT ($): 80.00

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

[x] No. [ ] Yes, the name of the U.S. Government agency and the Government contract number are: ______

Respectfully submitted,

SIGNATURE ______

Date November 19, 2004

TYPED or PRINTED NAME Christopher J. Daley-Watson

REGISTRATION NO. *(if appropriate)* 34,807

TELEPHONE (206) 359-8000

Docket Number: 413528009US

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

PTO/SB/17 (10-03)
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FEE TRANSMITTAL for FY 2004

Effective 10/01/2003. Patent fees are subject to annual revision.

[X] Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 80.00

Complete if Known	
Application Number	Not Yet Assigned
Filing Date	Concurrently Herewith
First Named Inventor	Andrew Rowser
Examiner Name	Not Yet Assigned
Art Unit	N/A
Attorney Docket No.	413528009US

METHOD OF PAYMENT *(check all that apply)*

[X] Check [ ] Credit Card [ ] Money Order [ ] Other [ ] None

[ ] Deposit Account:

Deposit Account Number: 50-0665

Deposit Account Name: Perkins Coie LLP

The Director is authorized to: *(check all that apply)*

[ ] Charge fee(s) indicated below [X] Credit any overpayments

[X] Charge any additional fee(s) or any underpayment of fee(s)

[ ] Charge fee(s) indicated below, except for the filing fee

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FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	770	2001	385	Utility filing fee	
1002	340	2002	170	Design filing fee	
1003	530	2003	265	Plant filing fee	
1004	770	2004	385	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	80.00

SUBTOTAL (1) ($) 80.00

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

			Extra Claims		Fee from below		Fee Paid
Total Claims		-20** =		x		=	
Independent Claims		-3** =		x		=	
Multiple Dependent						=	

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	86	2201	43	Independent claims in excess of 3
1203	290	2203	145	Multiple dependent claim, if not paid
1204	86	2204	43	** Reissue independent claims over original patent
1205	18	2205	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0.00

***or number previously paid, if greater, For Reissues, see above*

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge – late filing fee or oath	
1052	50	2052	25	Surcharge – late provisional filing fee or cover sheet.	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for *ex parte* reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	420	2252	210	Extension for reply within second month	
1253	950	2253	475	Extension for reply within third month	
1254	1,480	2254	740	Extension for reply within fourth month	
1255	2,010	2255	1,005	Extension for reply within fifth month	
1401	330	2401	165	Notice of Appeal	
1402	330	2402	165	Filing a brief in support of an appeal	
1403	290	2403	145	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive – unavoidable	
1453	1,330	2453	665	Petition to revive - unintentional	
1501	1,330	2501	665	Utility issue fee (or reissue)	
1502	480	2502	240	Design issue fee	
1503	640	2503	320	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17(q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	770	2809	385	Filing a submission after final rejection (37 CFR 1.129(a))	
1810	770	2810	385	For each additional invention to be examined (37CFR 1.129(b))	
1801	770	2801	385	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify) ____________

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) 0.00

SUBMITTED BY				(Complete *(if applicable)*)	
Name (Print/Type)	Christopher J. Daley-Watson	*Registration No. (Attorney/Agent)*	34,807	*Telephone*	(206) 359-8000
Signature				*Date*	November 19, 2004

I hereby certify that this correspondence is being deposited with the U.S. Postal Service as Express Mail, Airbill No. EV528708433US, in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date shown below.

Dated: 11-19-04 Signature: ____________ (Vickie Hoeft)

Express Mail No. EV528708433US

A Directive, Broadband, High Gain, Active Antenna System

A. Rowser, C. Long, G. Borland, L. Hoarty

Technical Field

The disclosure relates to a broadband, high-gain, active antenna system, which while in its standard configuration operates with a bi-directive reception pattern but when affixed with a tuned scatter-plate operates with a directive reception pattern over several octaves of Radio Frequency (RF) spectrum.

Background

Most antenna development up to this point has focused on traditional passive, power transduction mechanisms, which rely on matching the radiation resistance of the antenna structure to the intrinsic impedance of free space and matching the output terminal impedance of the antenna structure to the input impedance of the receive system. There are numerous passive matching techniques and geometries that have been developed over the many years antenna technology has been in existence. Most of the innovation in antenna technology has been in the Aerospace, Defense and Satellite Communications industries, while Commercial Radio and Television have long relied upon technology that has been available for over 40 years.

The current Television (TV) spectrum extends from 54 MHz to 806 MHz, corresponding to wavelengths ranging from 5.6 meters to 37 centimeters respectively. The more efficient, passive TV antenna designs commonly used can be relatively large and involve fairly elaborate geometries, to accommodate this range of frequencies. Typical TV antenna designs range from simple narrowband dipole structures, designed to be ½ of a wavelength at the frequency of interest, to more exotic broadband structures such as the log periodic dipole array, which consists of several dipoles of decreasing size arranged coaxially. An efficient log periodic array can exceed 3 meters in length, with the longest dipole element reaching up to 2.7 meters. An array of this size can achieve gains as high as 5 dB to 9 dB over that of a dipole, which typically is around 2 dBI at a resonant ½ wavelength. This advantage over the dipole is a result of directive gain associated with the particular combination and relative phasing of the array elements. The single dipole has a bi-directional radiation/reception pattern and a bandwidth of around 30%, whereas the log periodic array is designed for a highly directional radiation/reception pattern and can accommodate bandwidths of several octaves.

Electrically small antennas are becoming more common in recent years due to size constraints imposed on many wireless consumer electronics. Also, there is a growing interest in this technology within the TV broadcast community as applied to indoor

analog and digital TV reception and the indoor reception of Datacasting services. For example, a consumer residing in an apartment may require a high-gain, directive antenna to receive broadcast DTV and/or an on-demand movie service via datacasting, but does not have the space to utilize a typical log-periodic array. In this case, only an electrically small, broadband, high-gain antenna, with some directive selectivity for interference rejection, would be practical. There are indoor antennas available to the consumer designed with these applications in mind, but most perform at low efficiencies and utilize active electronics to amplify the low-level antenna output power. Antennas such as these are often referred to as "active antennas" or "integrated active antennas", even though they are simply passive antennas with low-noise amplifiers (LNA) conditioning the output signal. The antenna section of these assemblies are acting as power transducers and still must be impedance matched to the LNA at all frequencies of interest to be useful. As a result, the indoor TV antenna designer must utilize broadband design techniques to achieve a broadband impedance match between the antenna output and the LNA input over several octaves of the TV frequency spectrum. If the additional requirement of directivity/spatial selectivity is imposed, the design becomes much more challenging.

Brief Description of Drawings

Figure 1 shows an embodiment of the invention where the antenna system is in a directive configuration; and

Figure 2 depicts a high-impedance, differential voltage amplifier circuit utilizing lossless feedback to maximize input impedance and linearity in accordance with the embodiment of the invention.

Detailed Description

The invention will now be described with respect to various embodiments. The following description provides specific details for a thorough understanding of, and enabling description for, these embodiments of the invention. However, one skilled in the art will understand that the invention may be practiced without these details. In other instances, well-known structures and functions have not been shown or described in detail to avoid unnecessarily obscuring the description of the embodiments of the invention.

The terminology used in the description presented below is intended to be interpreted in its broadest reasonable manner, even though it is being used in conjunction with a detailed description of certain specific embodiments of the invention. Certain terms may even be emphasized below; however, any terminology intended to be interpreted in any restricted manner will be overtly and specifically defined as such in this Detailed Description section.

Figure-1 depicts a high gain, broadband, directive active antenna system. This active antenna system consists of a pair of dipole probe elements (a) connected to a highly linear, balanced amplifier with large input impedance (b), and a tuned scatter-plate assembly (c).

This antenna system is based on an electric field (E-field) sensor active antenna approach, which marries an antenna probe element or elements to a high impedance voltage amplifier to produce an E-field sensing transduction mechanism. This approach presents some inherent advantages, including broadband reception due to the lack of necessity for impedance matching between the antenna probe elements and the high input impedance voltage amplifier. Another advantage of this approach is that the size of the antenna probe elements are not dependent upon wavelength as passive antenna geometries are in order to accomplish resonance at the frequencies of interest.

Figure-2 depicts a preferred amplifier embodiment, which is a high-impedance, differential voltage amplifier design. Through the implementation of passive, lossless feedback, this differential voltage amplifier accomplishes scaleable gain, improved linearity and even greater input impedance than other common voltage amplifier designs. The lossless feedback circuit is comprised of a wire-wound transformer (a) connected as depicted to a Field Effect Transistor (FET) (b) or other high impedance transistor type. The effective gain of the voltage amplifier is determined by the turns ratio of the transformer and can be scaled accordingly. To further reduce the noise contribution of the amplifier to the antenna system, a bias decoupling inductor (c) is used to decouple the noise contribution of the bias resistor network (d) from the input of the transistor. In the preferred embodiment, a broadband inductor design was implemented at (c) to ensure low noise operation across the entire VHF and UHF bands. The inductance value of (c) can be chosen such that a RF voltage peaking effect can be obtained at the transistor input at the desired frequency. The combination of the lossless feedback voltage amplifier design with the E-field sensor active antenna approach results in an electrically small, active antenna system with a broadband frequency response, scalable gain, very low amplifier noise contribution and wide dynamic range.

As a standalone active antenna system, the antenna probe element and amplifier subassembly, described above, exhibit the bi-directional directive properties of a standard dipole of a fixed length. With the addition of a scatter-plate to the subassembly, this active antenna system becomes directive with separate, frequency-dependant directive modes. Towards the lower half of the bandwidth of interest, the antenna system operates in a directive, capacitively-coupled loop mode, in which the fringing electric fields at the ends of the antenna probe elements, capacitively couple to the scatter-plate creating a directive loop effect. Towards the upper half of the bandwidth of interest, the wavelength is small enough relative to the design geometry, such that the antenna system operates in a reflector mode. The scatter-plate can be tuned such that these separate directive modes occur at convenient areas of the RF frequency spectrum. The tuning mechanisms are 1) distancing of the scatter-plate from the driven elements and 2) the effective inductance of the scatter-plate. The scatter-plate's effective inductance can be affected by material properties and geometry. Other means of achieving directivity using the antenna probe

element and amplifier subassembly include: combining multiple subassemblies into arrays (fixed or steerable); combining a driven subassembly with a non-driven director element; as well as combining a driven subassembly with any number of non-driven director elements and a scatter-plate/reflector assembly.

In the case of an active antenna system designed for broadband TV reception, as a preferred embodiment (Figure-1), the scatter-plate (c) dimensions and proximity to the antenna subassembly (a & b) are chosen such that the antenna exhibits a minimum front to back directive ratio (F/B) of +8dB at High VHF and UHF frequencies. In this case, the overall length of the antenna probe element and amplifier subassembly is 22" and the 4.5" by 27" scatter-plate is located 3" from the center line of the antenna subassembly. It should be possible to achieve similar directive properties at lower frequencies, such as Low VHF TV and FM radio channels, if the scatter-plate geometry is tuned appropriately for those frequencies.

Unless the context clearly requires otherwise, throughout this application, the words "comprise," "comprising," and the like are to be construed in an inclusive sense, as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to." As used herein, the terms "connected," "coupled," or any variant thereof, means any connection or coupling, either direct or indirect, between two or more elements; the coupling of connection between the elements can be physical, logical, or a combination thereof. Additionally, the words "herein," "above," "below," and words of similar import, when used in this application, shall refer to this application as a whole and not to any particular portions of this application. Where the context permits, words in the above Detailed Description using the singular or plural number may also include the plural or singular number respectively. The word "or" in reference to a list of two or more items, that word covers all of the following interpretations of the word: any of the items in the list, all of the items in the list, and any combination of the items in the list.

The above detailed description of embodiments of the invention is not intended to be exhaustive or to limit the invention to the precise form disclosed above. While specific embodiments of, and examples for, the invention are described above for illustrative purposes, various equivalent modifications are possible within the scope of the invention, as those skilled in the relevant art will recognize. For example, while processes or blocks are presented in a given order, alternative embodiments may perform routines having steps, or employ systems having blocks, in a different order, and some processes or blocks may be deleted, moved, added, subdivided, combined, and/or modified. Each of these processes or blocks may be implemented in a variety of different ways. Also, while processes or blocks are at times shown as being performed in series, these processes or blocks may instead be performed in parallel, or may be performed at different times.

The teachings of the invention provided herein can be applied to other systems, not necessarily the system described above. The elements and acts of the various embodiments described above can be combined to provide further embodiments.

Any patents and applications and other references noted here, including any that may be listed in accompanying filing papers, and including U.S. Application No. 10/269,200 filed 10/3/02 (attorney docket no. 41352.8005), are incorporated herein by reference. Aspects of the invention can be modified, if necessary, to employ the systems, functions, and concepts of the various references described above to provide yet further embodiments of the invention.

These and other changes can be made to the invention in light of the above Detailed Description. While the above description details certain embodiments of the invention and describes the best mode contemplated, no matter how detailed the above appears in text, the invention can be practiced in many ways. Details of the antenna system may vary considerably in its implementation details, while still being encompassed by the invention disclosed herein. As noted above, particular terminology used when describing certain features or aspects of the invention should not be taken to imply that the terminology is being redefined herein to be restricted to any specific characteristics, features, or aspects of the invention with which that terminology is associated. In general, the terms should not be construed to limit the invention to the specific embodiments disclosed in the specification, unless the above Detailed Description section explicitly defines such terms. Accordingly, the actual scope of the invention encompasses not only the disclosed embodiments, but also all equivalent ways of practicing or implementing the invention.

What is claimed is:

1. An apparatus as generally shown and described herein.

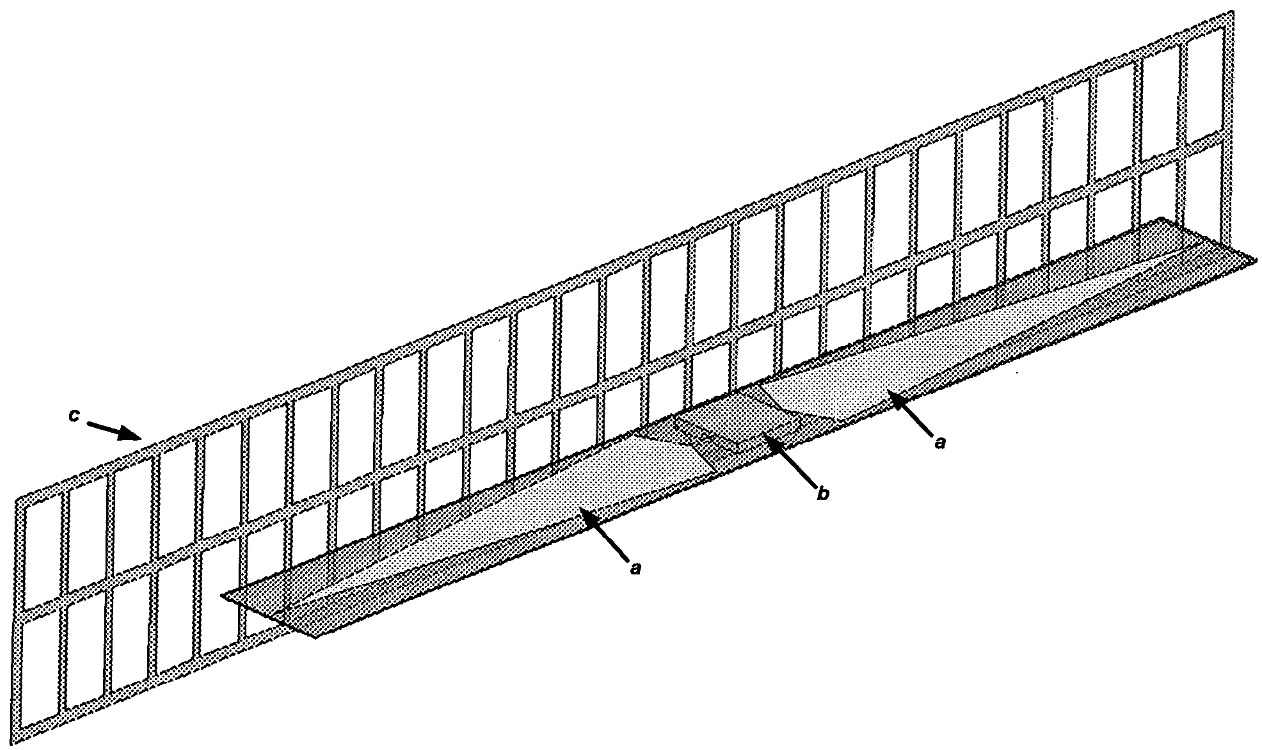

Figure 1: Directive antenna system general configuration

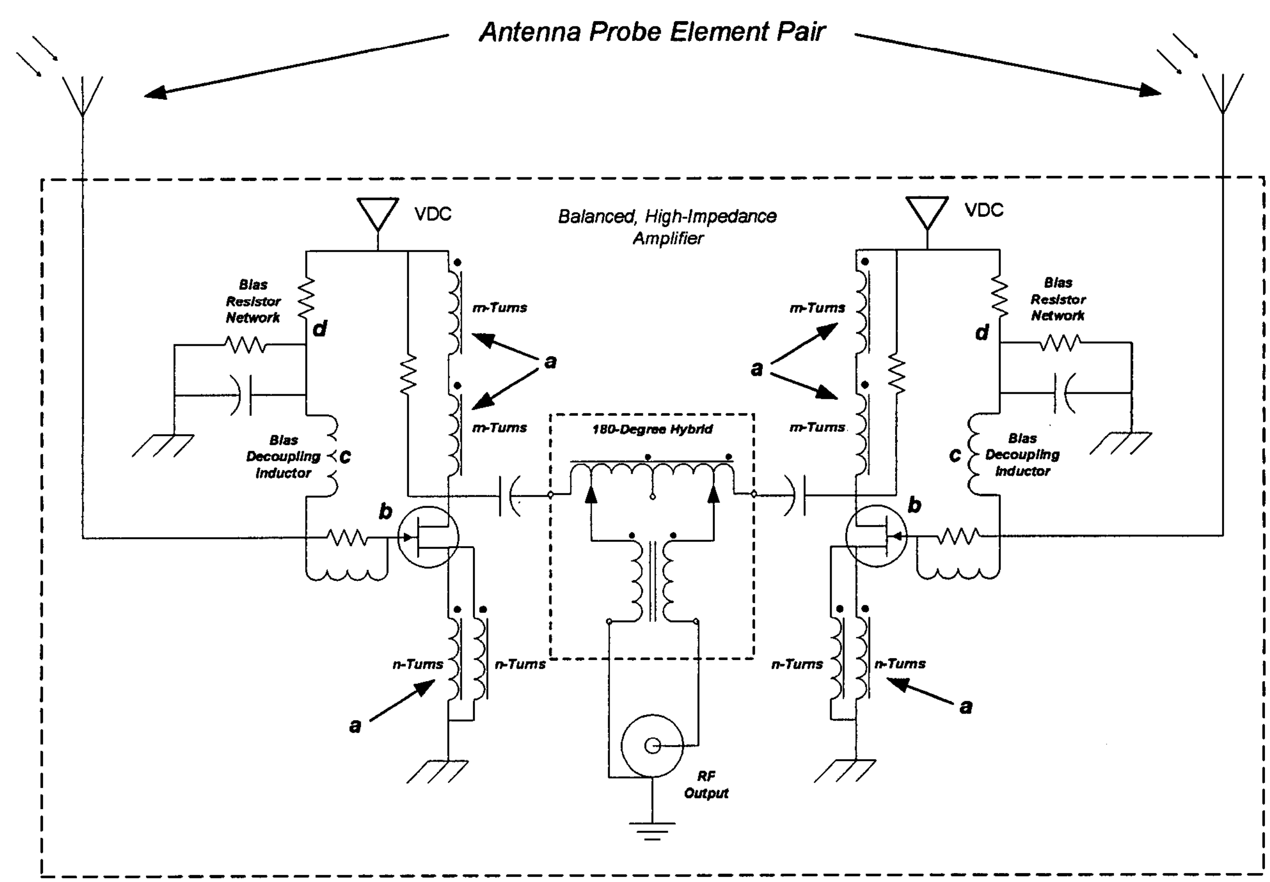

Figure 2: Schematic of high-impedance, differential voltage amplifier utilizing lossless feedback for greater linearity.